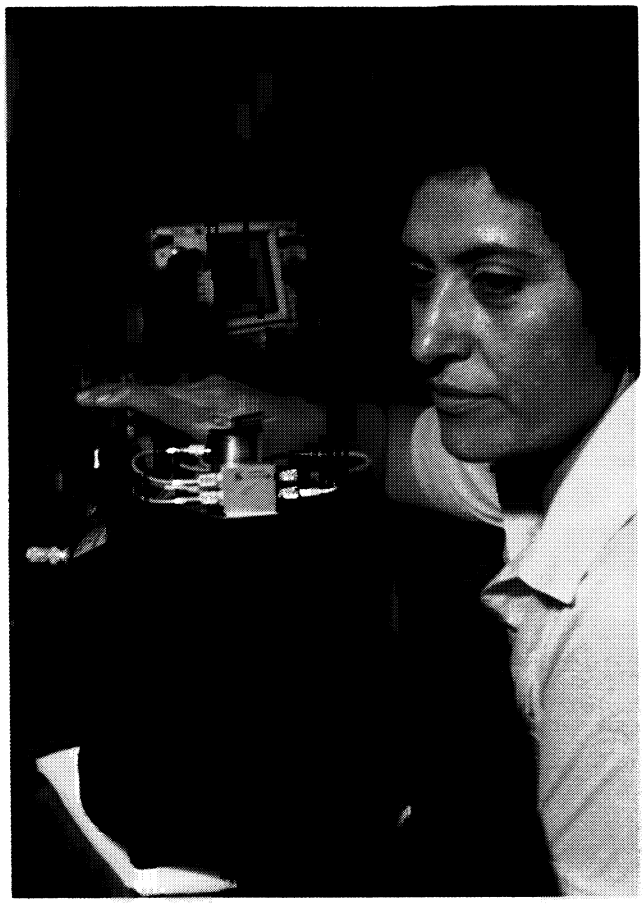
Loose Particle Detection

PIND is an acronym for Particle Impact Noise Detection, a means of finding tiny, loose, conductive particles, introduced during fabrication of integrated circuits, which sometimes cause system failures. The instrument pictured is one of two types of automated systems used for PIND testing. Produced by Dunegan/Endevco, San Juan Capistrano, California, it determines the presence of loose particles by detecting the sound of an impacting particle. PIND testing equipment is also produced by B&W Engineering Services, Costa Mesa, California.

The device undergoing test is attached to an acoustic transducer mounted on a shaker. The test equipment induces a series of shocks and vibrations to free particles clinging to the interior of the device. When a freed particle strikes some interior portion of the electronic package, the sound energy of the impact—which is in the ultrasonic range and inaudible to the human ear—is detected by the transducer. The resulting signal is used to provide both audio and visual monitoring of the test. If the signal exceeds a certain threshold, a light on a panel indicates that the device being tested has failed.

Goddard Space Flight Center made an important contribution to the technology with a study, completed last year, intended to determine PIND effectiveness. Previous attempts to quantify PIND testing had involved examination of failed parts to confirm the presence of loose particles—but parts which passed the PIND test were not examined for the absence of particles because that would have required destruction of costly items. The Goddard study was designed to determine true PIND effectiveness by foreknowledge of which parts contained particles—and therefore should fail the PIND test—and of other parts which did not contain particles, and therefore should pass. Goddard sent electronic packages to some 70 organizations—semiconductor manufacturers, users and test laboratories—for PIND testing, having beforehand introduced loose materials in 80 percent of the packages.

Analysis of the test data indicated that an average PIND detection capability of about 45 percent can be



expected. There are many variables which can reduce or increase that figure significantly—operator motivation and training, the test equipment and its condition, the package style of the device under test, repeated testing of the parts, the size of the contaminating particle and operating test conditions, for example, whether the test site is noisy or quiet. Although the 45 percent figure seems low, Goddard experts feel that PIND is the best available test method and accurate knowledge of its detection capability is necessary to determine PIND's cost-effectiveness and to judge the merit of employing it in systems of different criticalities.